1-Iminoalkylimidazoles *via* Cuprous Imidazolide

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1-Iminoalkylimidazoles are obtained from the novel reaction of cuprous imidazolide with alkyl halides and nitriles. The condensation produces a new class of imidazole derivatives and the ease of the reactions suggests a reasonable scope. The compound *N*-(1-*N*-*t*-butylimino)ethylimidazole exhibits nematicidal activity against larvae of *Meloidogyne javanica* at 1 ppm.

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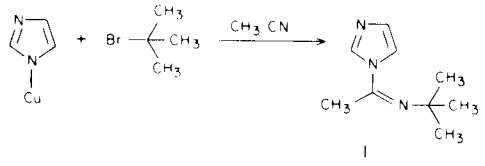
Mono *N*-alkylation of imidazoles with bulky substituents is not a facile process [1]. The *N*-*t*-butyl compound, for example, has been isolated only in poor yield as the picrate [2]. In an attempt to prepare this substance we have refluxed cuprous imidazolide [3] with *t*-butyl bromide in acetonitrile under argon. The reaction, however, took an unexpected and novel course (equation 1). The product *N*-(1-*N*-*t*-butylimino)ethylimidazole (**1**) is the first example of an "iminoimidazole".

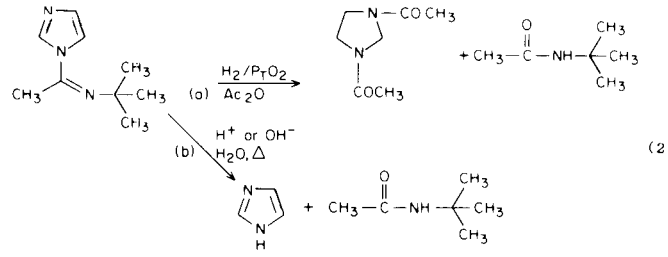


(1)

A reaction mixture composed of 10.0 g (0.0767 mole) of cuprous imidazolide, 10.6 g (0.077 mole) of *t*-butyl bromide and 250 ml of acetonitrile under argon was vigorously stirred and gently refluxed for 4 hours. During this time, the mixture gradually changed from a very faint, light greenish cast to a very light tan. After cooling, the reaction mixture was poured in 1 ℓ of ether. Copper salts were removed by vacuum filtration and the filter cake was washed with ether. The combined ether extract was washed with 3:1 water-ammonium hydroxide, water, dried-over potassium carbonate, filtered, and concentrated. The concentrate will crystallize, but recrystallization is difficult because the substance is hydroscopic. The solid distills as a clear water white liquid, bp 101°/0.05 mm and crystallizes, mp 45°, yield 5.0 g. The material sublimes readily at 50° *in vacuo*; ms: (parent) 165, (P-CH_3) 150, (P-*t*-Bu) 108, (isobutylene) 56 and (acetonitrile) 41; ir: C-H at 2973, 2935, 2908, 2870 cm^{-1}; C=N, 1676; other strong bands 1469, 1377, 1361, 1283, 1202, 1049 cm^{-1}; nmr (deuteriochloroform): δ 1.4 (s, 9H), 2.25 (s, 3H), 7.08 (1H), 7.58 (s, 1H), 8.08 (s, 1H). There is slight splitting between the δ 7.08 and δ 7.58 ring hydrogens.

Anal. Calcd. for $C_9H_{15}N_3$ (165): C, 65.41; H, 9.15; N, 25.43. Found: C, 65.32; H, 9.11; N, 25.43.

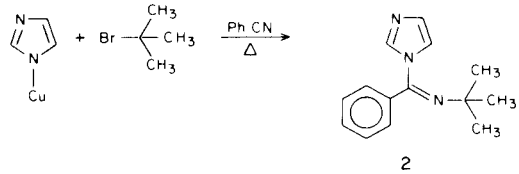
The structure assigned to **1**, based upon elemental and spectral analysis, was confirmed by degradation. Hydrogenation of **1** in acetic anhydride [4] afforded 1,3-diacetylimidazolidine [5] and *t*-butylacetamide [6] in 98% yield. Two moles of hydrogen were absorbed (equation 2a). Acid or basic hydrolysis of **1** in water produced *t*-butylacetamide and imidazole [7] (equation 2b).



(2)

Attempted direct synthesis of **1** from *N*-acetylimidazole and *t*-butylamine failed. The acetyl moiety was transferred to the amine. Moreover, there is no reaction between cuprous imidazolide and refluxing acetonitrile [8]. An acid catalyzed reaction of *t*-butyl alcohol with acetonitrile and imidazole, under Ritter conditions [9] did not alkylate imidazole and yielded only the imidazolium ion. Finally, reaction of *t*-butyl bromide with imidazole in acetonitrile produces only *N*-*t*-butylimidazolinium bromide and no **1**. Thus reaction 1 is unique.

Condensation in benzonitrile yields the corresponding phenyl derivative **2** [10] (equation 3). The ease of the condensations (1) and (3) suggests a reasonably broad scope for reactions between copper salts, organic halides and multiple bonds.



(3)

The imidazole unit is a part of a wide range of medicinal and physiologically active structures [11]. We find compound **1** but not **2** at 1 ppm, exhibits nematicidal activity against larvae of *Meloidogyne javanica* (root knot nematode).

REFERENCES AND NOTES

[1] M. R. Grimmet, "Advances in Heterocyclic Chemistry", Vol 12, A. R. Katritzky and A. J. Boulton, eds, Academic Press, New York, 1970, p 103; *ibid.*, Vol. **27**, 1980, p 241.

[2] P. Fournari, P. DeCointet and E. Laviron, *Bull. Soc. Chim. France*, **6**, 2438 (1968); *Chem. Abstr.*, **69**, 106622u (1968).

[3] Prepared from ammoniacal solutions of cuprous sulfate and imidazole.

[4] H. Bauer, *J. Org. Chem.*, **26**, 1649 (1961).

[5] Mp, mixed mp, and ms corresponded with an authentic sample prepared by the hydrogenation of imidazole, ref [4].

[6] Mp, mixed mp, nmr, ir, ms, compared with an authentic sample prepared *via* K. Sjoberg, *Acta Chem. Scand.*, **22**, 1287 (1968).

[7] Mixed mp, ms.

[8] This observation is in keeping with the general lethargy of organocopper derivatives toward nitriles, *cf.* A. E. Jukes, "The Organic Chemistry of Copper", in "Advances in Organometallic Chemistry", Vol 12, F. G. A. Stone and R. West, eds, Academic Press, New York, 1974.

[9] L. I. Krimen and D. J. Cota, "Organic Reactions", Vol 17, John Wiley and Sons, New York, 1969, Chapter 3, p 213.

[10] Bp 125°/0.01 mm, **2**, was characterized by analysis and degradation in the manner described for **1**.

[11] O. L. Salerni, "Natural and Synthetic Organic Medicinal Compounds", The C. V. Mosby Co., St. Louis, 1976.